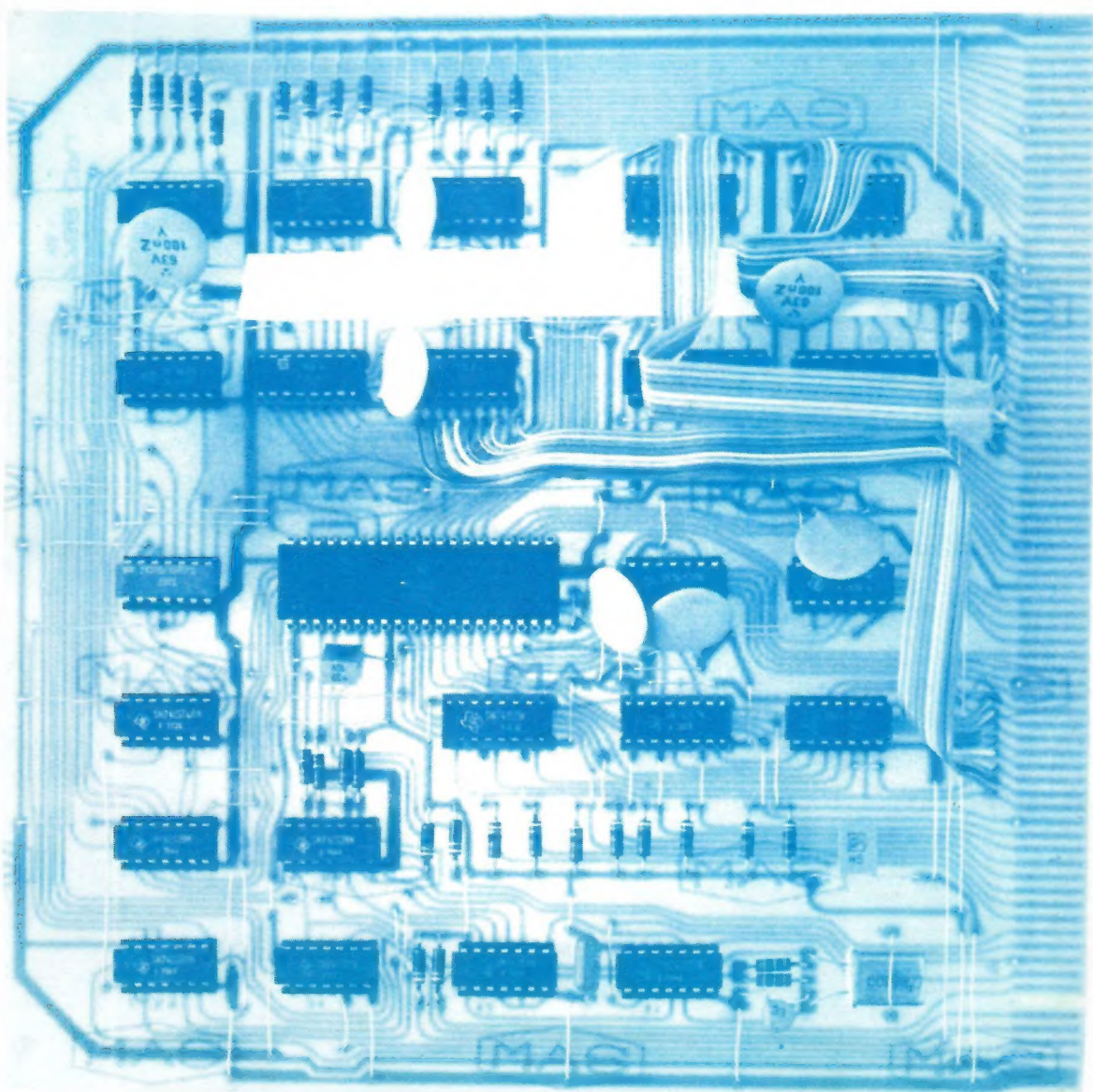


Mar-Apr/May-June 1981

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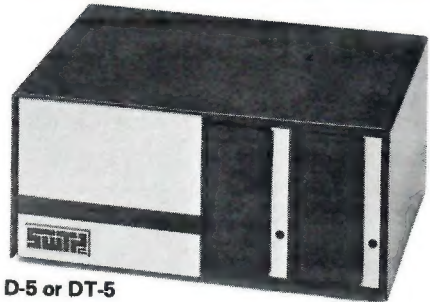
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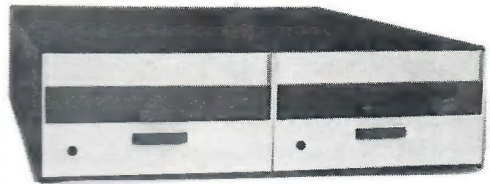
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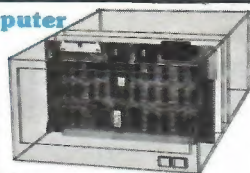
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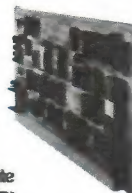
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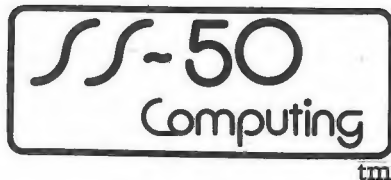
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Ken Orme

Assistant Publisher/Editor
Robert Wood

Review Editor
Gary Manning

Office Manager
Typesetting/Camera
Bonnie J. Orme

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SS-50 Computing
133 North Mayfield Ave.
Garland, Utah 84312

Send Correspondence To:

SS-50 Computing
P.O. Box 398
Garland, Utah 84312
Phone
[801] 257-5733

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**COVER PHOTO - A European 6800
CPU card...the "Newbear 77-68" taken
by Peter Bendall. See article on p. 17**

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OS-9 REVIEW

A MODULAR OPERATING SYSTEM

by Ken Orme

OS-9 from Microware is a versatile multi-programming operating system for the 6809. It manages memory, I/O, and CPU time for efficient operation and is a powerful interface that is easy to learn and use. It features device independent unified I/O that is expandable.

This operating system is a result of developing the BASIC09 Advanced Programming Language development by Microware and Motorola between 1978 and 1980. The design is modeled somewhat after Bell Telephone Laboratories 'UNIX' operating system. Microware explains that a "clone" of UNIX for the 6809 would be easy to implement, but since UNIX was designed for fairly large-scale minicomputers (such as the PDP-11), it is expected to have high CPU throughput, large and fast disk storage devices and a static I/O environment. Also, it is not particularly time or disk-storage efficient when used with low-cost disk drives.

OS-9 retains the overall concept and user interface of UNIX, but rather than

dynamically swapping programs on and off the disk, it keeps running programs in memory and emphasizes efficient use of available RAM. Also, it supports re-entrant software that can be shared by several users simultaneously which reduces overall memory requirements. It does have "Fork" and "Execute" calls that have been improved over the UNIX equivalents.

It effectively handles modular ROMed software by using the "Memory module" and LINK features to permit ROMed software to be automatically identified, linked, shared, updated and repaired.

The nice thing about OS-9 is the fact that it is modular. That means for the small systems, just 2 or 3K of RAM would be needed in addition to the 6809 CPU and 4K of ROM. A large system could consist of several disk systems (including hard disks), multiple terminals and 256K (or more) of RAM with memory management hardware (the Level Two OS-9 system). Level Two will handle up to one megabyte of memory.

SYSTEM STARTUP

The startup procedure is very simple. Turn the computer on...the master disk drive select light should come on, and then just insert the OS-9 system disk and close the door. It will load a couple of modules into memory and then display a startup message:

Shell

OS-9:

At this point, we had trouble the first time we tried to run, because we didn't get the startup message. Later, we found out that our memory was not addressed contiguously, which is one of the things mentioned, as a "must" in the instructions. After correcting this problem, the system fired up just like it should.

As you can see from the startup message, the first thing that comes up is the "shell". The shell surrounds the kernel of a seed and so it seems reasonable that the "shell" program surrounds the "kernel" or core of OS-9. You most likely will be running the system console until you get OS-9 commands and features tried and tested. After that, additional terminals and operators may also operate the system after "logging-on". It requires a correct user number and password before you may talk to the Shell.

After the prompt is displayed, you may begin to enter commands to the Shell. The normal command line is a PROGRAM NAME with PARAMETERS added. The program name is usually typed with the path list, file name, or other parameter after it.

The command programs include:

ATTR - Sets file attributes
BACKUP - Make backup of disk
BUILD - Build a new text file
CHD - Change working
Data directory

CHX - Change working Execution directory

COBBLER - Build a new boot file

COPY - Copy data from a path to another

DATE - Display system date

DEL - Delete a file

DIR - Display Names in Directory

Dump - Perform a File Dump

Echo - Echo Input line to Output

EX - Execute Program

FORMAT - Format a new diskette

FREE - Display free space on device

KILL - Abort a process

LIST - List contents of a text file

LOGIN - Log user into system

LOAD - Load modules into memory

MAKDIR - Make a new Directory file

MDIR - Display Module Directory

MFREE - List free memory areas

OSogen - Makes boot file from keyboard entries

PROCS - Display procedure & status

RENAME - Change file name

SAVE - Copy Memory Module to File

SETIME - Start and set system clock

setpr - Set Process priority

TMODE - Change Terminal mode

TSMON - Timesharing terminal monitor

UNLINK - Release Memory Module

VERIFY - Verify module's CRC and header

Even though some of the command programs are for disk system only, most of them will work with a tape system as well. Even though we didn't have time to review OS-9 designed for tape systems, we will try to do so in a future article.

The main feature that makes OS-9 different from most other systems is that when you copy or list a program, it may be re-directed to another "path"

directories. Also, ownership and security attributes may be used just like a regular file.

SOME OBSERVATIONS

There are a few things that we felt could be improved after working with the system for a few weeks. One of them is the Manual(s). When approaching Microware about the problem, we learned that the manual we have is a preliminary one, and the new ones will arrive soon. The only thing that was not the best with the manuals that we received is that there are places that a little more explanation would have helped a lot. Also, a few of the examples given don't work as written. We're confident that the problem has been Taken care of.

Since the system needs interrupts to accomplish the work, we found that it would have been a lot nicer to have a disk controller board that uses them so there would be no "glitches". This is not a problem with OS-9, but with the disk controller board we used. By the way, one of the other controller boards we used works like a champ and has no interrupt connections, so there could be another problem with the first one.

We found the timesharing mode to be very efficient compared with other small systems we have seen. The line buffer accepts characters even when the system is loading a disk program, etc. The characters aren't echoed back until it has a second to do so, but otherwise most of the normal inputting occurs as fast as you can type. We were only able to experiment with two users up to now, but the slowdown due to two users was very minimal. A lot of disk operations, especially with 5-1/4 inch floppy systems, will make timesharing quite slow, but running programs using RAM memory is nice.

We only have two complaints about timesharing -- one deals with the manual again. Since it was a preliminary one, we can assume that it

has better instructions for bringing up the timesharing system in it. A file called "password" must be created and what to do after that is not too clear. The second complaint we have deals with going back to single-user operation. How can it be done? Nothing is mentioned in the operations or system preliminary manuals.

Our main observation and conclusion about OS-9 is that it is a powerful operating system that will work with smaller systems as well as larger ones and still gives you "UNIX"-like operations, complete with "pipes" and "forks". True multitasking and multi-programming features are here with the ability to have several users running one re-entrant program at the same time. If you are looking for an operating system that is "state of the art", not prohibitively expensive, and one that will be supported by all kinds of users and yet fit in a smaller 6809 system, then the only choice is OS-9.

Microware is a company that you can have confidence in, not only for the delivery of the product, but for exceptional support. As an example of this support and assistance, Microware has installed a phone set aside just for technical assistance and questions. It is available from 9 a.m. to 5 p.m. •[Central Time] Monday through Friday. The number is (515) 279-8898. In talking with the folks at Microware, you can expect to see several new programs offered this summer. One of the first to appear will be their PASCAL which meets the full ISO standards and has floating point and interger math. Also a software "switch" to use either P-code or the optimized code. More on this at a later date.

For further information and pricing on OS-9, contact Microware Systems Corporation, 5835 Grand Ave, Box 4865, Des Moines, Iowa 50304. Also, see the Microware ad in the centerfold of this magazine.

[SS-50]

to have more of a showing at such a large event.

The official count for attendance at the Faire this year was 31,729 but was low, due to those who are dishonest and sell their badges on the way out to interested people coming in. There were 520 booths and exhibits, which should give you an idea of the size of it.



Many new ideas were presented and many interesting conference programs were presented, but for the 68XX user this year, most were of general rather than specific interest. In talking with Jim Warren, the chairman of the Computer Faire, we should plan now to have some user's meetings and/or topics of discussion for the next one.

I'm sure that many, many others will agree with us that it would be one of the best public relations efforts that could be given for the 68XX family of processors if at least one meeting out of the 100 held at the Faire were to be based around the 6800 or the 6809. There was at least one meeting held with the 6809 as its base last year. Terry F. Ritter was there discussing "Modular and Structured Programming on Small Systems (Including 6809

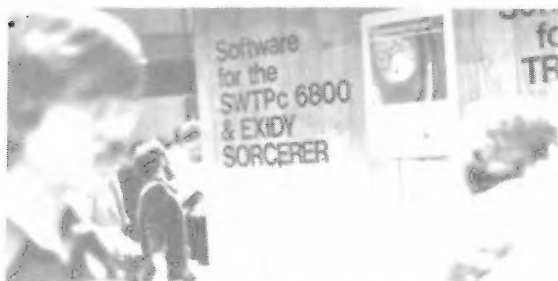
Assembly Language)". In case you don't know, Terry is from Motorola and is one of the best authorities on the 6809 processor in the world since he is a co-architect of the 6809. I'm sure that if we were to have a program dealing with some of the "state of the art" systems software now being produced for the 6809 it would turn a few heads and let people know about the third generation from Motorola.

There are many users in the "Silicon Valley" area and therefore it seems to me that we could stir up at least one meeting for the 68XX people. I realize that there are other shows around the country, and that it is a long haul for some of the hardware and software people, but we will all mutually benefit from attending.

The West Coast Faire seems to draw a lot of technically oriented people and still has the cross section of hobbyists, business systems users, and general "looking for a computer" types. Just by attending the Faire, we found out several things in store for us just ahead.

Some of the booths of interest included the Japan Microcomputer Club with a "sneak preview" of the Hitachi MB6890 (6809 processor) color com-





Programma's Booth



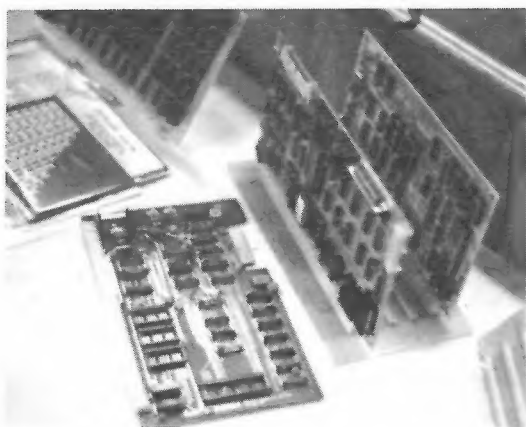
Harold Mauch, president of Percom Data Company, talking with some of the many interested Faire goers



Ray Boaz from BOAZ CO. talking with the Percom people



Adults and kids alike, all enjoyed the fun and giveaway items



Some of the "System 50" boards from Percom on display at the Faire



The Osbourne 1 personal business computer drew a lot of attention

BASIC BUG

DIM Routine Not Very Bright

Geoffrey A. Gass
5240 S. W. Dosch Rd.
Portland, Oregon 97201

There's a minor bug in at least some of the distributed copies of SWTPC Disk BASIC 3.5 for the 6800, bundled with FLEX 1.0 for the DMAF-1 dual 8 inch disk.

The program rejects multiple DIM statements of the form.

10 DIM A(10),B(15),C(5)

with irrelevant error messages such as "ERROR #30 (illegal disk file number) IN LINE #10" -- though statements of the form

10 DIM A (10): DIM B(12): DIM C(5)
are accepted.

The problem is in a wild offset in a branch instruction at address \$1721. Instead of an offset of \$C8, the code reads \$C2, branching back, not to the reentry point in the DIM routine for the next variable, but to the third byte of a three-byte instruction.

Luckily, the error just causes a peculiar error message, and does not chew up BASIC, crash the disk, or do any of the other things predicted by Murphy's law.

Change the \$C2 at \$1721 to \$C8 and the bug will go away.

[SS-50]

INTRODUCING...

Peter Bendall
from West Germany

Peter Bendall has lived in or near Hamburg for the last six years. He is English, and works for a lab as a "computer engineer" and with the help of a 'computer scientist' runs the computer part of the support group of the out-station in West Germany.

Mr. Bendall has been in computing or electronics since leaving school, and has lectured on programming mini-computers at a teachers' training college and a local Computer Club sponsored evening classes. He has had papers in the last three DECUS (Digital Equipment Users) symposiums in Bonn and Esslingen, and hopes to have a joint one in the next English DECUS at Warwick.

Peter is married and the father of five children, two of which have left home to start their own families. He took up home computing when he moved into an apartment where he could no longer use his Ham station. Mr. Bendall constructs his own equipment, either from kits (like his own 48K 7768) or from scratch. This has rubbed off onto his work where he is using the F & D CPU-2 to connect an electric typewriter to their lab's PDP-11s. He is also in possession of a radio-teletype terminal unit which is up and functional. It works really well with his mechanical RTTY machine and hopes to get it receiving on the 6800 system soon. There is a UHF RTTY relay about 25 miles away and hopes to later be able to work other Ham stations.

Peter also has an acoustic coupler, and would like to get a second with both originate and answer, and successfully has loaded S1 format from long distances.

We certainly appreciate this article from Peter Bendall, and to learn about the 6800 system in our European countries.

1K extra RAM and a monitor in two 2708s. The Kansas City Interface is on board. Changing the EPROMs and adding a keyboard and the video interface board to the on board PIA, converts the system to an ASCII type monitor. A 16K RAM can be connected to the unbuffered bus connector.

The popularity of Eurocom has attracted several small companies to produce Eurocom 'add-ons' such as memory and I/O boards. Because of the standard Eurocard, the 6502 systems have also produced very similar ranges of boards with a bus that is almost exactly the same as that of the 6800 systems, so that accessories such as buffered motherboards, memory extensions and I/O boards can be used with almost no modifications needed.

CLUBS

The overall club scene in Europe is that a large number of local clubs and one-system user groups. A notable

exception is the 'Amateur Computer Club' in England, though it is itself large enough to support local interest groups united through the newsletter 'ACCumulator', and backed up by libraries for the main micro-processor families. The ACC was responsible for a lot of the original interest in the 7768 system as it published the circuits for the system and a lot of the 7768 software in earlier issues of its newsletter.

Several groups and clubs sprang up out of Radio Club or Computer Club construction projects, and from evening classes in microcomputing. One problem that hits the European user when leaving the beginning phase is how to obtain suitable software at affordable prices and getting it to run on his system when he can get it. Both 7768 and Eurocom-I have monitors at \$Fxxx, and non-standard IO addresses.

The 7768 has also unusual 40 x 24-line VDU display at \$F800. The various clubs collect and distribute the essential patches to allow the user to run his system with the software when he gets it.

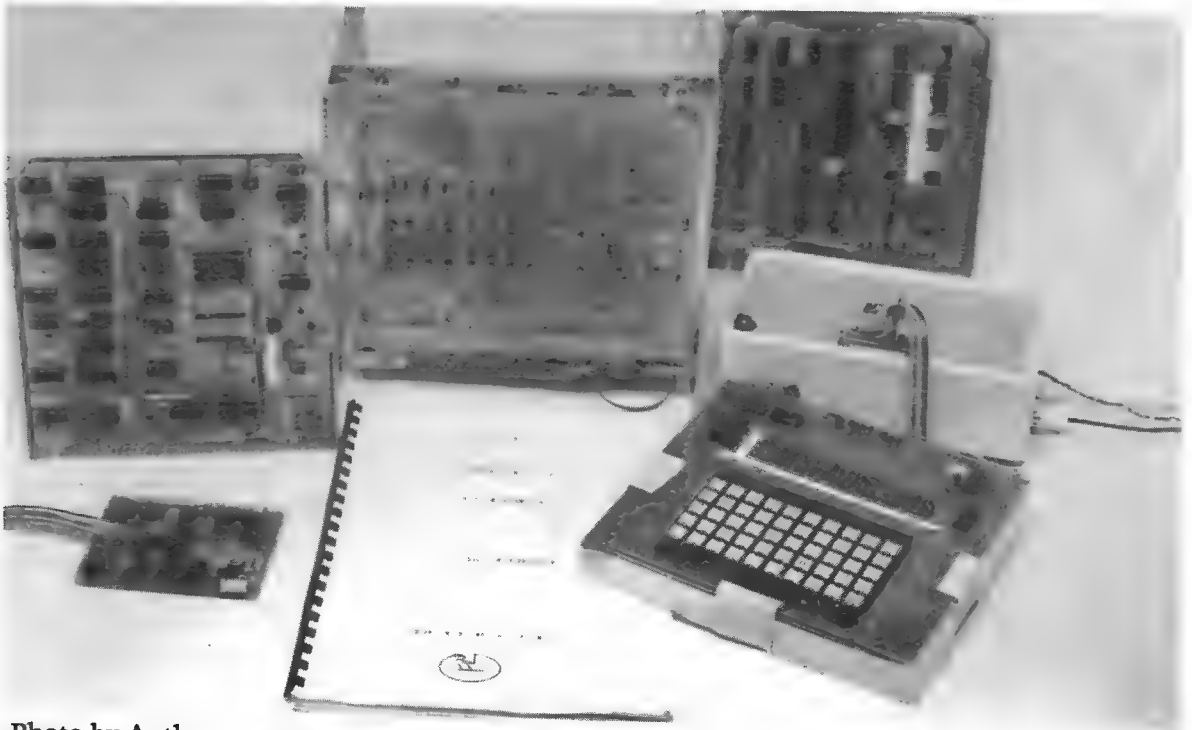


Photo by Author

HITACHI MB-6890

One of the biggest attractions at the West Coast Computer Faire, was the HITACHI MB-6890 Computer. The hallway near the Japan Microcomputer Club exhibit (where the MB-6890 was located) was almost always crowded to the point that you couldn't get through. Even though Hitachi was not displaying their new arrival for the purpose of selling it, there was surely a lot of interest as to when it would be sold here and how much it would cost.

The heart of the system is the 6809 microprocessor and therefore should be of interest to most of us. In the basic setup, the MB-6890 contains 32K of RAM (expandable to 62K on board), and a 24K BASIC in ROM (from \$A000 to

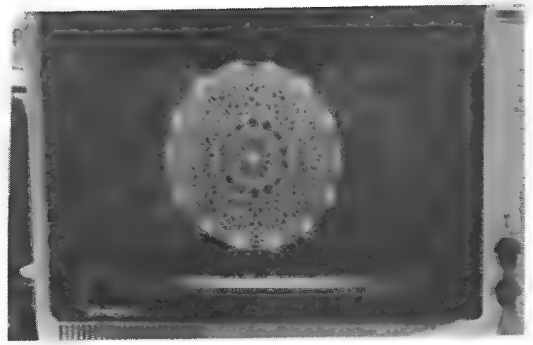
\$FF00) with I/O located from \$FF00 to \$FFFF. The system has beautiful, full-color, high resolution graphics that puts many systems to shame. It comes with a built-in 600 baud cassette tape interface, a built-in light pen, an RS-232 interface, a parallel port, and a video output. The 640 x 200 high-resolution graphics display looks very good on the optional C14-2170 video monitor designed to match the system. Also available is the dual floppy disk drive (MP-3540), which interfaces to the machine easily. The light pen plugs into the machine via a 5 pin connector with internal decoding and BASIC commands for it built-in. An eight pin connector is used to output video



information from the computer video circuitry including horizontal and vertical sync pulses, and red, blue, and green color information.

The word is that the BASIC is from MICROSOFT. It appears to be a good, extended BASIC which includes several features that are developed for the MB-6890. Some of the commands unique to this system include: LOADM, SAVEM, EXEC, NEW ON, PAINT, SCREEN, INPUTWAIT, KEYn (Used for DATE\$, TIME\$, TERMINAL, SCREEN, COLOR, LOAD, LIST, RUN, LIGHTPEN, and CONT *single key* modifications.). Also, ON COM - GOTO, PEN, and ON PEN - GOSUB. The BASIC is very complete and allows many variations in graphic oriented programs as well as regular programs. It features single precision variables at 7.1 digits and double precision to 16.8 digits. Long variable names (up to 15 characters) are allowed and it has some nice screen editing features.

The case features room for up to six additional boards to be connected to the bus with access out the back. Also available on the back is a standard RS-232 connector, a parallel port connector, the video output connector, a cassette tape connector, and the 8 pin color video connector. The bus system consists of a 56 pin card-edge style connector, with the normal SS-50C signals available (plus a few others). In the upper right-hand portion of the case, a small compartment door will open to allow access to the power switch, the volume control for the sound, a mode switch, and the reset switch. The keyboard is standard size with a 23 key numeric keypad to the right. There are 59 ASCII keys and 5 programmable function keys. The numeric keypad has add, subtract, multiply, and divide keys, the cursor control keys, a return key and a few others. The keyboard we saw had Japanese "Hiragana" characters available in the shifted mode, but when marketed in the U.S. it will probably have upper and lower case letters.



The advertised prices in Japan are 298,000 Yen for the MB-6890 alone. The color monitor is 168,000 Yen, and the dual disk system sells for 298,000 Yen. Although we don't have the means to find the current exchange rate locally, those of you that are interested can probably find out.

A bit more on the graphics. This machine has one of the best graphics displays we have seen. A few others will top it, but not within the price range. The fact that the screen will display 25 lines of 80 characters or 25 lines of 40 characters lets you know that you can probably select high or low resolution graphics. Well you can select not just two, but *four* resolutions by software control. They include: 640 x 200 dots or 320 x 200, 160 x 100, and 80 x 100 with color. Speaking of color, the display can contain both characters and graphic symbols with 6 colors besides white and black and will allow you to specify both foreground and background color. Some systems have more colors than this, but most are very limited on the high resolution end of things.

This article is not meant to be a sales pitch for Hitachi, since we don't know if the machine will ever be available here, but mostly because of the interest from you. If any of you readers have other news of this machine, feel free to share it with us.

[SS-50]

Editor's Note -

We would like to thank Richard Keightley for first calling our attention to this Computer.

Flex and OS-9 on the SWTPc 6809

by Gary Manning

If you have been interested in getting OS-9 for your 6809 system, but still want to be able to use your present software, you can have it both ways at the flip of a switch if you have a Southwest system with a MP-09 board (and probably most other systems as well). All it will cost you is a double pole double throw switch, some wire, and an optional four pin connector and plug.

The OS-9 firmware for a Southwest system consists of three 2K (2716 type) ROMs. Microware intends for two of the ROMs to be placed in a ROM board and ROM No. 1 to replace the monitor at \$F800-\$FFFF. The other two are position independent and can be located most anywhere in the memory space. Since the MP-09 board has three ROM sockets, I thought, "Why not use them?" These sockets are intended for use in small dedicated applications such as single board controllers, etc. Their use in a system is discouraged, but they can be used if you know how.

The address and use of the MP-09 ROM sockets are as follows:

Socket No. 4 (\$F800-\$FFFF) is for the monitor and cannot be disabled. Socket No. 3 (\$F000-\$F7FF) is enabled or disabled by the fourth switch in the switch block S1. The address area is reserved for DMA devices, so if you don't have any, you're okay so far. Socket No. 2 (\$E800-\$EFFF) is enabled or disabled by S1, #3. This address area is reserved for upper I/O and should be unused on most systems. Socket No. 1 (\$E000-\$E7FF) is enabled or disabled by S1 - #2. This address area conflicts with I/O and cannot be used as it is, but this socket can be re-addressed.

The secret of being able to switch operating systems, is to have two sockets addressed at \$F800-\$FFFF (one for each monitor) and switching to select one or the other. Sockets No. 1 and 4 will be used this way, the other two need not be modified.

You may have some reservations about all of this because it seems too simple, but it gets better. Since FLEX and SBUG-E don't care about memory from \$E080-\$F7FF, you can leave the OS-9 ROMs 2 and 3 enabled in this area all of the time. If you can't place the ROMs in this area, you will have to devise a means to disable them so that they don't conflict with FLEX. Also, I had some questions about how the Dynamic Address Translator (DAT) would behave under OS-9, but we have never had any problems with it since installing OS-9. One thing that is required with OS-9 is that all of your memory must be in a contiguous block.

Before beginning to modify the CPU board, you need to consider if you want to place the switch on the CPU board, or on the front panel of the cabinet.

For the switch on the front panel, you should find a four conductor plug and connector similar to the abort/reset connector so you will be able to remove the board from the system when desired by simply unplugging the switch connector. You should also consider where you will mount the switch. I used a small toggle switch which I mounted in the black stripe above the reset switch. By mounting the switch in the black stripe, I could cover the hole with a new piece of black tape if I ever decided to remove the switch.

The modification is simple, but a little difficult to explain. Make sure you understand before you do it. First, the select traces to ROM sockets No. 1 and 4 must be cut. For socket No. 4, the trace runs from IC #6 - pin 13 to ROM socket #4 - pin 18 and 20. This trace can be best accessed as it comes down from IC #6 - pin 13 on the front of the board, just to the left of the processor chip. Make sure you have

the right trace, then cut it and solder some small insulated wire to each side of the cut. If you have two colors of wire, use both to help keep things straight. For socket No. 1, the trace runs from S1 - #2 to ROM socket No. 1 pins 18 and 20. Be careful to leave the pull-up resistor (R6) on the select side of the cut, not the socket side. The best place to cut this trace is on the back of the CPU board. Socket No. 1 is the lower left-most socket as viewed from the back side. Its select line runs along the top of the socket to a feed-through just above pin #24. Cut the trace about halfway between the two rows of pins of socket No. 1. Again, solder a wire to each side of the cut, but use the same color for each side as you used for socket No. 4. In other words, make sure you have the select side of both cuts coded the same and the socket side coded the same.

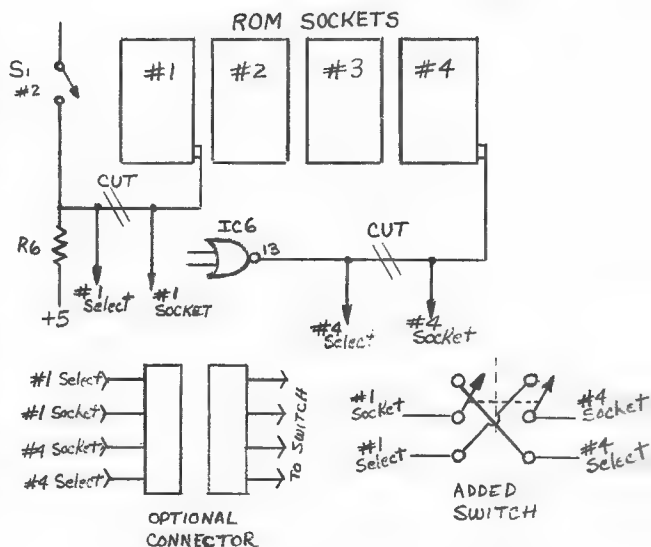
Carefully mount the connector or switch on the CPU board. You may drill holes and mount it if you have room (depending on the size of the connector), or glue it on with epoxy or "instant" glue. It would also be wise to ground the switch housing for some static protection.

Carefully route the four wires to the switch or connector. You may find some glue will keep them "tacked" to the board. The DPDT switch in the illustration is divided by the dotted line and has the common terminal in the center of each half. Use this for a reference and adjust if necessary for the switch you use. The connector (if used) will be discussed later.

Connect the socket side of socket No. 1 to one of the common terminals, then connect the socket side of socket No. 4 to the other common terminal. Next, the select side of socket No. 1 should be connected to the switch terminal above the common, *and* to the switch terminal below the common on the other side. Connect select No. 4 to the two remaining terminals. If the connector is used, and it is non polarized, wire it as shown so that if it

is reversed, it will only affect the switch position, but will still work.

Plug OS-9 ROM #1 in socket No. 1, plug OS-9 ROM #2 in socket No. 2, plug OS-9 ROM #3 in socket 3, and leave SBUG-E in socket No. 4. Place the jumpers for sockets 1-3 in the ROM position. Set the switches on S1 as follows: #1 - always on, #2 - *must be off*, #3 - on and #4 - on. Place the CPU on the motherboard, plug on the connectors and turn on the power. If you haven't predetermined which monitor is selected by one position or the other, you will come up in one or the other (of course). If you come up in SBUG-E, you will get the usual prompt. However, if you come up in OS-9, the disk drive #0 will come on. After you insert the OS-9 disk, the system will load, and the OS-9 prompt will appear on the screen. To change monitors, simply flip the switch and hit reset.



If OS-9 fails to come up, switch over to SBUG and try it. If it won't come up either, then you have a wiring error. If SBUG works but OS-9 doesn't, make sure that your memory is in a contiguous block from \$0000 up, and check your wiring.

We have had our system running this way for several months now and have had no problems with it.

[SS-50]

OS-9™ LEVEL TWO MULTIUSER OPERATING SYSTEM

T rue multitasking, multiuser OS for timesharing or real-time control applications.

- Sophisticated memory management permits use of over one megabyte.
 - Versatile, easy-to-use input/output supports multiple devices.
 - UNIX™-like file structure including hierarchical directories, pipes, filters, and byte-addressable random access files.
 - Provides log-on password protection and user file security.
 - Can run on small, inexpensive systems with floppy disks and as little as 32K memory.
- ☐ \$495.00*

OS-9™ LEVEL ONE OPERATING SYSTEM

S ingle-user, single-memory map compatible subset of Level Two for software development or stand-alone control applications.

- Versatile input/output system can support multiple devices using interrupt-driven, DMA, or program-controlled data transfer. Users can easily add additional I/O devices.
 - Tape or disk-based versions available.
 - Disk versions support UNIX™-like hierarchical directory structure and byte-addressable random-access files.
 - Memory management for single address-space (up to 64K).
- ☐ Disk version \$150.00*
☐ Tape version \$95.00

BASIC®™ PROGRAMMING LANGUAGE SYSTEM

E xtended BASIC language compiler/interpreter with integrated text editor and debug package. Runs standard BASIC programs or minimally-modified PASCAL programs.

- Permits multiple named program modules having local variables and identifiers. Modules are reentrant, position independent and ROMable.
- Additional control statements for structured programming: IF ... THEN ... ELSE, FOR ... NEXT, REPEAT ... UNTIL, WHILE ... DO, LOOP ...

INTRODUCING

6809 SOFTWARE POWER TOOLS

BY MICROWARE

ENDLOOP, EXITIF ... ENDEXIT.

- Allows user-defined data types and complex data structures. Five built-in data types: byte, integer, 9 digit floating-point, string and boolean.
- Extremely fast program execution.
- Available on ROM, disk or cassette tape. Runs under OS-9™ Level One or Level Two.

☐ Disk or tape \$195.00*

MICROSOFT 6809 BASIC

S tandard Microsoft BASIC optimized for the 6809 and OS-9™.

- Four data types: integer, string, single precision and double precision floating point.
- Program trace and edit capabilities.
- Automatic line numbering and renumbering.
- Supports random and sequential file I/O. Full PRINT USING for formatted output.

☐ Disk or tape \$250.00

OS-9™ TEXT EDITOR

M inimum-keystroke macro text editor useful for text preparation or interactive word processing.

- User-defined macros with parameters permit virtually unlimited command expansion. Macros can be saved, loaded

and edited.

- Buffer, line and character oriented commands.
 - Search, change and extend operations.
 - Permits multiple input/output files.
- ☐ Disk or tape \$75.00
☐ ROM set (2716) \$90.00

OS-9™ INTERACTIVE ASSEMBLER

Compact Motorola compatible assembler for machine language program development.

- Operates in "batch" mode or interactive line-by-line mode.
- Facilities for generation of OS-9™ memory modules and system calls.
- Formatted listings include syntax and context error checking.

■ Runs on OS-9™ Level One or Level Two.

☐ Disk or tape \$75.00
☐ ROM set (2716) \$90.00

OS-9™ INTERACTIVE DEBUGGER

F acilitates testing and debugging of machine- language programs.

- Includes common "monitor" functions: memory examine/change, breakpoints, display/change registers, hexadecimal arithmetic, etc.
 - Access to system command interpreter.
 - Available on ROM, disk or cassette tape.
- ☐ Disk or tape \$35.00
☐ ROM (2716) \$50.00

BASIC ® is a trademark of Motorola. OS-9 is a trademark of Motorola and Microware®. UNIX is a trademark of Bell Telephone Laboratories.

Most software is available on ROM, diskette and tape in versions for many popular 6809 computers. Source listings and yearly maintenance/update service are sold separately for most programs.

*Specify manufacturer and type of CPU and I/O controllers. Contact Microware® for specific availability.



MICROWARE®

Microware Systems Corporation
5835 Grand Avenue, Box 4865
Des Moines, Iowa 50304
(515) 279-8844

INNOVATION AND PERFORMANCE

A/BASIC COMPILER

This BASIC compiler generates pure, fast, efficient 6800 machine language from easy to write BASIC source programs. Uses ultra-fast integer math, extended string functions, boolean operators and real-time operations. Output is ROMable and runs without any run-time package. Disk versions have disk I/O statements and require 12K memory and host DOS. Cassette version runs in 8K and requires RT/68 operating system.

- ☐ Disk Extended Version 2.1
SSB or FLEX* Diskette \$150.00
- ☐ Cassette Version I.O. \$65.00

A/BASIC SOURCE GENERATOR

An "add-on" option for A/BASIC Compiler disk versions that adds an extra third pass which generates a full assembly-language output listing and assembly language source file. Uses original BASIC names and inserts BASIC source lines as comments.

- ☐ SSB or FLEX* Diskette \$75.00

A/BASIC INTERPRETER

Here it is - a super-fast A/BASIC compiler! Now you can interactively edit, execute and debug A/BASIC programs with the ease of an interpreter - then compile to super efficient machine language. Also a superb stand-alone applications and control-oriented interpreter. Requires 8K RAM. The cassette

6800 SOFTWARE SUPER POWER

BY MICROWARE

version is perfect for Motorola D2 kits.

- ☐ Cassette, SSB or FLEX* Diskette \$95.00

LISP INTERPRETER

The programming Language LISP offers exciting new possibilities for microcomputer applications. A highly interactive interpreter that uses list-type data structures which are simultaneously data and executable instructions. LISP features an unusual structured, recursive function-oriented syntax. Widely used for processing, artificial intelligence, education, simulation symbolic, and computer-aided design. 6800 LISP requires a minimum of 12K RAM.

- ☐ Cassette, SSB or FLEX*
Diskette \$75.00

*FLEX is a trademark of Technical Systems Consultants

RT/68 REAL TIME OPERATING SYSTEM

MIKBUG — compatible ROM that combines an improved monitor/debugger with a powerful multitasking real-time operating system. Supports up to 16 concurrent tasks at 8 priority levels plus real time clock and interrupt control.

Thousands in use since 1976 handling all types of applications. Available on 6830 (MIKBUG-type) or 2708 (EPROM-type) ROM. Manual is a classic on 6800 real-time applications and contains a full source program listing.

- ☐ RT68MX (6830) \$55.00
- ☐ RT68MXP (2708) \$55.00

6800 CHESS

A challenging chess program for the 6800. Two selectable difficulty levels. Displays formatted chess board on standard terminals. Requires 8K memory. Machine language with A/BASIC source listing.

- ☐ Cassette, SSB or FLEX* Diskette \$50.00

Our software is available for most 6800 systems on cassette or diskette unless otherwise noted. Phone orders welcomed. We accept MASTERCARD and VISA. We try to ship orders within 24 hours of receipt. Please call or write if you require additional information or our free catalog. Microware® software is available for OEM and custom applications.



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STYLOGRAPH WORD PROCESSOR FOR OS-9

Stylograph is a full-featured screen-oriented word processing program for creating and printing documents. Stylograph's interactive operation and human-engineered features make it the most accurate and easy-to-use kind of document-preparation system. Cursor-based editing commands and real-time screen refresh always gives an accurate picture of what the printed document will look like.

■ Powerful Editing Commands

The display cursor can be moved character-by-character, line-by-line, or page-by-page in any direction. The full compliment of "cut-and-paste" edit commands permit blocks of text to be moved, copied, searched for, replaced and deleted. The "global replace" command searches for each occurrence of a given text string and allows selective replacement with another string. In the "insert" mode the text is actually formatted before your eyes as you type!



■ Complete Formatting Control

Text or individual lines can be center, left, right, or left-and-right justified; page and line width can be specified; multiple tabs can be set anywhere. You can define page heading, footers, page numbering, indentation and line spacing.

■ Versatile Video Terminal Interface

The basic Stylograph module uses a "personality module" to define the display control codes used by many brands of video terminals and memory-mapped video displays including: Hazeltine 1400/1500 series; Lear-Seigler ADM3-A; GIMIX 80x24; SWTPC CT-82 and 8212; and ADDS Regent series.

- ☐ \$175.00
- ☐ For proportional printers \$195.00

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BOAZ

64K Dynamic Memory Update

By Ken Orme

Since the article was written on the BOAZ 64K Dynamic Memory Board, we have a few other things that should be mentioned. Those of you who have the early versions of the board will find that there may be a problem with extended addressing as is. This is due to an error that occurred on the board, not in the design of the memory board circuitry. However, we received an update shortly after the article was written, explaining what to do to use the board with extended addressing. Since we had not tried it, we assumed that it worked as well as the rest of the board. The fix is simple, and is now corrected on the boards being produced currently, but we mention it here mainly if someone has a board and desires to use it with extended addressing and needs the update, they can write to BOAZ Co. to get the information, or we would be happy to provide a photocopy.

One of the points that we should bring up is that the manual being furnished with the memory board is

now much improved and is very good at explaining the jumpers and addressing. We were shipped a preliminary manual and that is why we had the comments on it.

All the IC's that are furnished with the BOAZ boards are tested before shipping to insure that they are in proper working order. I'm sure that is why almost every single kit has worked the first time (according to the last word we received).

There are a couple of new things that are possible with the board for those that are interested. The memory as designed will operate at basic clock frequencies of 898.5 KHz to 1 Mhz. Included with the latest documentation is a modification to allow the board to operate at 1.25 Mhz. This covers the range of the MP-A and MP-A2 as well as the higher rate for 8 inch floppy operation. Also, for those that have DMA disk controllers, there is an outboard modification that you may make to allow you to use both the BOAZ Dynamic memory and the DMA controller. You should write Ray Boaz directly for this modification if it is needed.

One note of interest about the future. Ray Boaz informs me that he has one board using the new 64K Dynamic RAM chips operating. It only requires 8 of these chips for 64K! Imagine, with the board filled up, having 256K of memory on one board. When the 256K chips hit the market, we will be able to have 1 Meg of memory on one board! Also, the 2 Mhz version of the board may come soon.

If any of you need further information, be sure to drop the folks at BOAZ Co. a line. Ray has been excellent to work with, and I'm sure that he will be glad to help any way he can. BOAZ Co., Box 18081, San Jose, CA 95158, (408) 269-9522.

[SS-50]



New Products

AMATEUR RADIO SOFTWARE

Your TRS-80C can now be used to receive and transmit Amateur Radio RTTY BAUDOT or ASCII code. The RTTY program is written to run on a minimum 4K TRS-80C Computer. The Color Computer is attached to your existing T.U. or one can be constructed. Instructions are provided to construct a T.U. from a kit and a AFSK modulator from a single XR-2206 IC. The hardware is interfaced through the RS-232 port on the rear of the computer. The software has the following features:

1. Transmit and receive BAUDOT 60 or 100 WPM and ASCII 110 baud. By simple BASIC "POKES", speeds from 110 to 9600 baud ASCII and 60 to 133 wpm BAUDOT can be received and transmitted.

2. A user defined CW call ID (up to 15 characters) can be transmitted. The program will prompt you for the call when it is first executed.

3. Three program buffers can be pre-loaded with up to 256 characters, and transmitted on ASCII or BAUDOT.

4. A "RY" buffer is provided to transmit a tune-in pattern on RTTY.

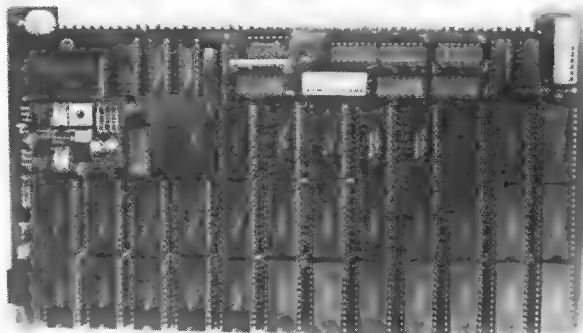
5. If you have a 16K TRS-80C, both RTTY and SSTV can be loaded into RAM and alternately selected. More features are provided than the ROBOT 800 in these modes.

6. The program produces automatic CR/LF and automatic upper-lower case shifting on BAUDOT keyboard entries.

Version 7.01 (above program) with cassette and documentation - \$20.00. Version 7.0 stripped-down version for 2716 EPROM. On cassette or customer provided EPROM \$15.00.

Also the SSTV software is available with cassette and documentation for \$20.00.

For further information or orders, contact Clayton Abrams (K6AEP), 1758 Comstock Lane, San Jose, CA 95124.



GIMIX 64K CMOS STATIC RAM

GIMIX, INC. announces their new 64K Byte CMOS STATIC RAM BOARD with battery back-up for the SS50/C bus. This board is fully compatible with any of the 6800/6809 DMA techniques. They are guaranteed for 2MHz operation with no wait states or clock stretching required. Ultra-low power CMOS RAM requires less than ¼ AMP (250 Ma.) at 8V for a fully populated 64K Byte board. It is non-volatile using an on-board nickel-cadmium battery. The board retains data even with system power removed. With the battery fully charged, the contents of the memory remains intact for a minimum of 21 days.

Since the entire board can be hardware write protected by a switch located at the top of the board, it can also be used to emulate PROM or ROM memory. This is especially useful during firmware development where frequent software changes must be made.

The GIMIX 64K BYTE STATIC MEMORY is available from stock and is priced at \$1088.64 and a 56K version, socketed for 64K is \$994.56.

For further information, or to order, contact: GIMIX INC., 1337 West 37th Place, Chicago, Ill 60609, (312) 927-5510.

POWER PACK

Computerware (tm) announces its POWER PACK for Radio Shack's new Color Computer.

The POWER PACK cartridge plugs into the Color Computer's interface slot providing 6K additional RAM memory and a powerful 2K monitor. The monitor provides the sophisticated programmer 33 powerful machine level commands and many utility routines. With its extra memory and routines in ROM, this new POWER PACK allows Computerware and other software sources to supply users with much more sophisticated software on cassette at much lower prices than the ROM packs currently available from Radio Shack. Computerware also includes with the POWER PACK a free cassette of diagnostics for the Color Computer.

Already available for use with the POWER PACK is Computerware's Color Editor (\$24.95), Color Assembler (\$29.95), and Color Invaders (\$19.95)!

Since Computerware has long been a leader of quality 6800/6809 products (from monitors, disk operating systems and BASICs to games and general ledger) Color Computer owners can be assured this is just the beginning of a long list of excellent products they will see from Computerware.

The POWER PACK is available directly from Computerware, Box 668, 1512 Encinitas Blvd., Encinitas, CA 92024, (714) 436-3512 at the introductory price of \$159.

COLOR INVADERS

Computerware introduces its Color Invaders on cassette for the Radio Shack Color Computer.

You are at the controls of the Color Computer Space Tank, firing at stellar ships and invading critters. Invading ships burst in air with explosive noise.

Alien critters march across the screen dropping bombs and screaming as life is zapped from their fried little bodies.

Fun?? Yeah!!

With brilliant color, dynamic sound and fast action, Color Invaders offers a continuous source of excitement to all players. Each of the 8 levels of play present additional complications keeping the beginner going and the experts challenged.

Color Invaders requires 16K and the POWER PACK to be installed (using the extra memory and powerful commands inside) and is priced at only \$19.95. It is available directly - Computerware, Box 668, 1512 Encinitas Blvd., Encinitas, CA 92024, (714) 436-3512.

A FORTH SOURCE

Mountain View Press, the FOURTH source, has a wide variety of printed publications for the FORTH language. While no machine readable information is handled by Mountain View Press, there is an extensive list of materials available for the installation of FORTH. For \$20.00, to cover the cost of an Installation Manual and a specific Source Listing, FORTH can be implemented on the purchaser's micro computer.

The following Source Listings are available: 8080 (will work on Z80), 6502, 6800, 6809, PACE, PDP-11, and Alpha Micro. All Source Listings are to fig-FORTH standards. "fig" is an abbreviation for the FORTH Interest Group, a worldwide group of over 2500 FORTH users that may be contacted at PO Box 1105, San Carlos, CA 94070.

A number of user and reference manuals and books about FORTH are also available from Mountain View Press. Some of these are: "Using FORTH", "A FORTH Primer", and "Tiny Pascal in fig-FORTH".

For further information contact: Mountain View Press, PO Box 4656, Mtn. View, CA 94040



FLEX, UNIFLEX, OS-9

by Harold Mauch
President, Percom Data Company

The effort we expended trying to develop 6800 software for the LFD-400 disk system rather painfully taught us that software development requires an enormous amount of time and manpower. Even the software vendors whose sole business is the creation of software do well to develop and document a single significant software package in one year! Consequently, when we began to develop 6809-based products, we decided to use outside vendor-developed system software when possible and reserve the in-house software effort for utilities, special drivers, application programs and customer support.

Since a good operating system is the foundation for both system and application

software, we contracted the various software vendors. FLEX/9 by TSC was developed first but was little more than a reassembly of the 6800 FLEX. It was definitely not "FLEXible" enough for the I/O intensive applications we envisioned for the 6809. UNIFLEX was still being developed but a review of the design specification revealed it was not practical for control applications because the memory requirement was too large and the I/O restrictions were very "unFLEXible".

The preliminary description of OS-9 was interesting. It had the device-independent I/O and UNIX-like features that we had come to appreciate in INDEX, plus the capability of supporting a broad range of hardware configurations ranging from simple ROM-based controllers to multi-tasking multi-user data processing systems. Although it took longer to develop than predicted, the result is well worth the wait. *OS-9 is everything we wanted in a 6809 operating system.* It was easily configured to run on a PERCOM 6809 adapter-modified 6800 computer as well as with the PERCOM SBC/9 MPU in a SYSTEM-50 configuration. Tim McKee of our technical staff performed the implementation and has provided several configurations which are set forth below.

Although most of our current and planned 6809 software development is designed for use with OS-9, the PSYMON ROM operating system and the MPX/9 disk system are still available for users with inexpensive or (uncomplex) 6809 system requirements.

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CONFIGURATION 1:

PERCOM SBC/9 with 2716 EPROM, LFD-400 Mini-Disk System, 48K byte memory (contiguous), SYSTEM-50 motherboard and power supply.

Memory Map	
FFFF-F800	OS-9 EPROM P1
F7FF-F7FE	Console ACIA
F7FD-F400	Room for I/O
F3FF-D000	Unused
CFFF-CC00	LFD-400 Drive I/O
CBFF-C000	OS-9 EPROMs PCM1, PCM2, & PCM3
BFFF-0000	RAM

CONFIGURATION 2:

MP-A2 CPU card with PERCOM 6809 Adapter, LFD-400 Mini-Disk System, MP-S serial I/O card, 32K bytes RAM, MP-B or MP-B2 motherboard and power supply.

Memory Map	
FFFF-E800	OS-9 All EPROMs
E7FF-D000	Unused
CFFF-CC00	LFD-400 Drive I/O
CBFF-8020	Unused
801F-8008	Free for I/O
8007-8004	Console ACIA
8003-8000	Free for I/O
7FFF-0000	RAM

CONFIGURATION 3:

MP-A2 CPU card (see note) with PERCOM 6809 Adapter, LFD-400 Mini-Disk System, MP-S serial I/O card, 48K byte RAM, MP-B or MP-B2 motherboard (see note) and p. supply.

Memory Map	
FFFF-F800	OS-9 EPROM P1
F7FF-E020	Unused
E01F-E008	Room for I/O
E007-E004	Console ACIA
E003-E000	Room for I/O
DFFF-D000	Unused
CFFF-CC00	LFD-400 Drive I/O
CBFF-C000	OS-9 EPROMs PCM1, PCM2, PCM3
BFFF-0000	RAM

Note: The MP-A2 and MP-B/B2 boards require slight modifications that are switch selectable. They may be returned to their original configuration by switching them off.

OS-9 ON THE PERCOM LFD-400

by Tim Mckee

Microwave is delivering their LFD-400 (tm) version of OS-9! It seems to work really well.

My first and most important recommendation, however, is: *Get the DEBUG package.* OS-9 has none of the debug features we have come to know and love. All that OS-9 does is execute a program. You cannot even modify memory without using 'DEBUG'.

DEBUG is perhaps the most extensive debug package that I have seen. It allows the use of complex numerical expressions, including register values and indirect addressing to several levels.

There are many valuable machine language utilities included on the diskette. Using 'DEBUG' and these utilities, you can create diskettes that will 'boot' with the I/O addresses set to whatever value you want.

The first machine that we successfully brought OS-9 up on was -- believe it or not -- a SWTPC 6800 system with a Percom 6809 adapter installed. This was an ordinary 6800 system: MP-A2 CPU card, 32-Kbyte memory from 0-\$7FFF, 8-Kbyte memory from \$A000-\$BFFF, MP-S card at \$8004 and a DC-2 disk controller.

Incidentally, adapting an MP-A2 card with our 6809 conversion card is the least expensive way that I know of to make the transition from a 6800 computer to a 6809. The 6809 Adapter is just \$69.95.

The only limitation of this system is lack of memory for large programs such as BASIC09. Even this limitation can be done away with by remapping the I/O to another address, e.g., \$EXXX, and modifying the processor card slightly.

Helpful Hints:

1. To change the number of tracks that will be formatted on a diskette:

SYSTEM	USER RESPONSE	COMMENT
OS9:	load format [CR]	[CR] = carriage return
OS9:	debug [CR]	--
DB:	l#format [CR]	# = space bar "character"
DB:	\$XXXX 87	--
DB:	.#. +39 [CR]	--
DB:	\$XXXX 23	--
DB:	=#TT [CR]	TT is (decimal) number of last track to be formatted.
DB:	q [CR]	q = quit DEBUG
OS9:	save <name> format [CR]	omit angle brackets
OS9:	unlink format [CR]	--

The new format utility may be renamed FORMAT.

2. The device descriptor blocks come with devices set to specific addresses. As long as you can map your terminal ACIA to its proper address once, you may change them as needed:

SYSTEM	USER RESPONSE	COMMENT
OS9:	debug [CR]	--
DB:	l#term [CR]	# = space bar "character"
SBC09 87	.#. +f [CR]	+f adds hex f to address
DB:	= XX [CR]	XX most significant byte of new console address
SBC18 F7	= YY [CR]	YY least significant byte of new console address
DB:	= YY [CR]	
SBC1A 13		
DB:	l#t1 [CR]	t1 is an auxiliary terminal
SBC3C 87	.#. +f [CR]	--
DB:	= XX [CR]	See note above for XX.
SBC4B E0	= YY [CR]	See note above for YY.
DB:	= YY [CR]	
SBC4C 00		
DB:	= YY [CR]	
SBC4D 13		

Changes for a parallel printer (p) or serial printer (pl) are made similarly.

DD:	1)clock [CR]	
SDDA1 87		
DD:	-X.+b [CR]	adds hex b to address
DD:		
SDDA2 88		
DD:	-XX [CR]	XX most significant
SDDA3 50		byte of MP-T address.
DD:	-YY [CR]	YY least significant
SDDA4 01		byte of MP-T address.
DD:		
DD:	q [CR]	Finished changes
OS9:	verify term [CR]	Primary terminal
OS9:	verify t1 [CR]	Auxiliary terminal
OS9:	verify p [CR]	Parallel printer
OS9:	verify pl [CR]	Serial printer
OS9:	verify clock [CR]	MP-T
OS9:	cobbler <drive> [CR]	<drive> /D0, /D1, etc.

When OS-9 is "booted" using the diskette you have just created, all I/O will be done through the new device addresses.

Data recovery while using the DC-2 disk controller card was very bad. In one instance, I was unable to even format a diskette. Using the same diskette and the same system I had no problems after making a modification to the DC-2 card.

It seems that SWTP used the internal data separator circuit on the Western Digital 1771 floppy disk controller chip. Even Western Digital recommends against this. The modification to correct this consists of installing a Percom SEPARATOR(tm). This inexpensive module (\$29.95) will work wonders on eliminating disk Read errors. Be sure to specify that it is to go on a SWTP disk controller.

INEXPENSIVE SPEECH FOR YOUR SYSTEM-50

by Sam Campbell

Many techniques now exist for speech processing.

Cost constraints, more than any other consideration, often will determine the type of speech process that is used with a system.

This article will introduce the concept of artificial speech and describe a way to add low-cost, high-quality speech to your System-50 computer.

PERCOM's SPEAK-2-ME-2(tm) interface module enables a host computer to control a Texas Instruments' SPEAK & SPELL by disabling the SPEAK & SPELL controller chip and taking control of its data lines.

Handshake between units is accomplished through an 8-bit port such as the modified PIA (Parallel Interface Adapter) port on your 680X computer.

Conversion of a SPEAK & SPELL to accomodate a SPEAK-2-ME-2(tm) is semi-permanent.

Because there is a fair amount of hardware modification required, you may want to take advantage of the installation service PERCOM offers, although most customers make the installation themselves.

An article by Tim McKee elsewhere in this issue of the Peripheral describes how to connect a SPEAK-2-ME-2-modified SPEAK & SPELL to a 6800 computer.

The production of speech in the human vocal system is a matter of the vocal tract being exercised by air from the lungs. There are two kinds of excitation, periodic and random. Periodic excitation is caused by the vocal folds blowing apart and collapsing under lung pressure. Random excitation is created by air rushing over the articulators -- lips, tongue and teeth -- with the vocal folds open.

The vocal tract, which is composed of the cavities of the head (nasal and mouth), filters the input. The placement of the articulators at any instant will determine the frequency of the sound produced, as filtered by the vocal tract. This complex time-variant filter network produces human speech.

To produce speech artificially requires an analog electrical signal that can approximate the human vocal process. Using filter oscillators, and noise generators this can be done fairly well. The complication is control of the static and dynamic parameters of speech.

Texas Instruments' SPEAK & SPELL learning aid uses a process based on a voice-compression technique called linear predictive coding (LPC). This technique can generate high quality speech at a low data rate -- less than 2400 bits per second. Linear predictive coding is so called because coefficients that characterize the digital filter may be predicted from a linear combination of the previous coefficients.

SPEAK & SPELL uses a modified calculator processor (TMC 0271) as its controller. This controller, a member of the TMS 1000 family, has been modified to enhance its binary-coded decimal arithmetic and expanded instruction set. The function of the controller is to pass data to the voice synthesis processor (VSP) and to the display, and to perform the number crunching mathematics required.

The VSP enables communication with the microprocessor and voice-memory. Speech data that has been compressed is supplied to the voice-processor either from the CPU or the voice-memory. The voice-processor decodes this data to produce a time-varying digital filter model of the vocal tract. This model is excited by a representation of either the glottal air impulse (voiced sounds) or the rush of air

(unvoiced sounds). The output of this model is passed through an eight-stage digital-to-analog converter to produce a synthetic speech waveform.

The voice synthesis memory (TMS 6100) stores the speech data as read-only memory. These ROM sets are 16,384 by 8-bit devices (128 Kbits) having an internal 18-bit address counter/register and two 8-bit output buffers. Fourteen of the address bits go to the memory array directly, while the four most significant bits are used in a 1 of 16 chip select. Data is fed serially out to the voice-processor using the ADD 8 line.

IMPLEMENTING SPEECH ON YOUR SYSTEM-50

By Tim McKee

This article discusses the hardware and software needed to interface a Texas Instruments' SPEAK & SPELL, which has been modified with a PERCOM SPEAK-2-ME-2 as discussed in Sam Campbell's article, to your 6800 computer.

There are two quick and easy ways to interface your speech unit using an M6821 parallel interface adapter (PIA). One, you can use a SWTP MP-LA card set for output on channel A and input on channel B, or, two, you can use a Percom 30-pin prototyping card with voltage regulation and a PIA, and work from there.

When you order a SPEAK-2-ME-2, you will be asked which of two cables you need. Either one works. The cable is shown in Figure 1.

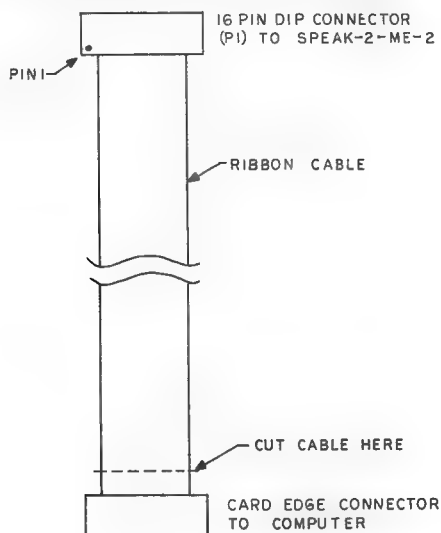
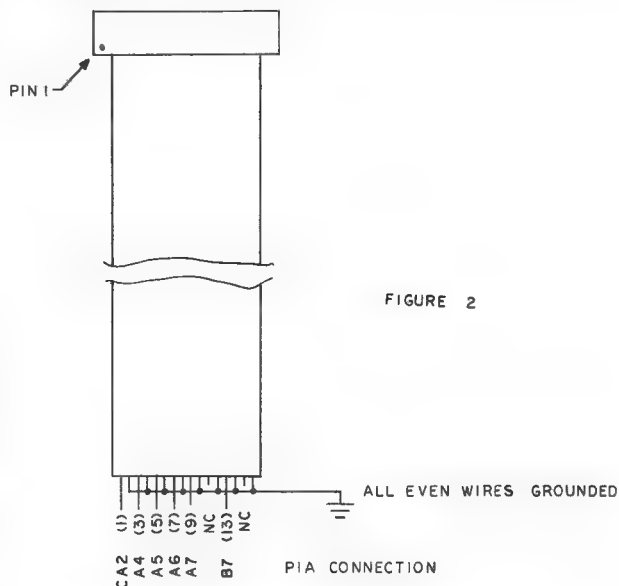


FIGURE 1

Cut off the connector at the computer end. You do not need this connector for your System-50 computer. Separate the wires of the cable to about two inches. Strip about 1/4-inch of insulation from each wire. Position the cable assembly as shown in Figure 1. The wires numbers, from left to right, are #1 to #16. Cut off #11 and #15. Connect all of the even-numbered wires to ground. The remaining wires are connected as shown in Figure 2.



Speech driver programs are included at the end of this article. If space permits, we will include an *advanced* speech driver in the next issue of the Peripheral.

Listing # 1 is a position-independent driver for SPEAK-2-ME-2. It assumes the PIA is located at \$8000 (port 0). Prior to calling the driver, you must store the word value in VALUE, which is located at the starting address :9. The code could be reassembled to accept the value passed in the Index register, on the Stack, etc. You should do a 'JSR' to the starting address. The driver will speak the word, wait for it to finish, then return. The contents of VALUE are destroyed.

Listing # 2 is a BASIC program that will allow you to install the above driver and initialize the I/O port. There must be an area of memory inaccessible to BASIC and your DOS where the driver will be stored. This address must be given in line #170. The BASIC must have a USER function, which allows you to use machine language routines from BASIC. The address of the 16-bit value that allows you to

point the USER function at your machine language routine must be specified in line #200. Lines #330 and #340 initialize the port at \$8000. If your PIA is at a different location, you must change these lines. Now, any word

in the SPEAK & SPELL vocabulary may be spoken. All that you must do is load variable A with the value of the word to be spoken and GOSUB 2000. AO must point to the first byte of the routine.

PERCOM 6800 ASSEMBLER

SPEECH DRIVER for 6800

* THIS DRIVER IS AN ADAPTATION OF THAT WRITTEN BY
 * JAMES STUTSMAN FOR THE TRS-80 MODEL I.
 * THIS DRIVER IS WRITTEN IN POSITION INDEPENDENT 6800
 * CODE. IT REQUIRES THAT THE CALLING PROGRAM STORE
 * THE VALUE OF THE WORD TO BE SPOKEN IN THE VARIABLE
 * 'VALUE'. THIS VARIABLE IS DESTROYED BY THE ROUTINE.
 * WRITTEN BY TIM MCKEE
 * COPYRIGHT PERCOM DATA CO. 1981

```
(8000) PIA EQU $8000
(8000) PIADTA EQU PIA
(8001) PIACTA EQU PIA+1
(8002) PIADTB EQU PIA+2
(8003) PIACTB EQU PIA+3
```

```
0000 8D 00 ENTRY BSR HERE
0002 30 HERE TSX
0003 EE 00 LDX 0,X GET ADDRESS OF 'HERE'
0005 31 INS
0006 31 INS FIX STACK
0007 20 02 BRA *+4 SKIP AROUND VALUE
0009 00 00 VALUE FDB 0
000B A6 07 LDA A VALUE-HERE,X
000D E5 08 LDA B VALUE-HERE+1,X
000F A7 08 STA A VALUE-HERE+1,X
0011 E7 07 STA B VALUE-HERE,X DRIVER REQUIRES REVERSED SEQUENCE
0013 AA 07 ORA A VALUE-HERE,X OR THE TWO HALVES
0015 26 0C BNE SPEAK SPEAK WORD IF NON-ZERO
0017 C6 05 LDA B #5
0019 4F RESET CLR A
001A 8D 2F BSR STROBE SEND A ZERO
001C 5A DEC B
001D 26 FA BNE RESET MUST SEND 5 TIMES
001F 86 80 LDA A #$80
0021 20 28 BRA STROBE
```

* THE FOLLOWING CODE WILL 'SPEAK'

```
0023 4F SPEAK CLR A
0024 8D 25 BSR STROBE
0026 4F CLR A
0027 C6 05 LDA B #5
0029 8D 37 OUTADD BSR SHFTX4 SHIFT LEAST SIGNIFICANT NIBBLE IN
002B 8D 18 BSR OUTCHR SEND NIBBLE
002D 5A DEC B
002E 26 F9 BNE OUTADD
```

Percom PERIPHERAL


```

0030 86 80      LDA A #$80
0032 8D 17      BSR STROBE
0034 86 A0      LDA A #$A0
0036 8D 13      BSR STROBE
0038 86 E0      LDA A #$E0
003A 8D 0F      BSR STROBE
003C 4F        CLR A
003D 8D 0C      BSR STROBE

```

* WAIT FOR COMPLETION OF WORD

```

003F B6 8002 WAIT LDA A PIADTB GET STATUS WORD
0042 2A FB      BPL WAIT
0044 39          RTS

```

```

0045 36          OUTCHR PSH A
0046 86 20      LDA A #$20
0048 8D 01      BSR STROBE
004A 32          PUL A
004B 43          STROBE COM A
004C B7 8000      STA A PIADTA PUT DATA ON LINES
004F B6 8001      LDA A PIACTA GET CONTROL CONTENTS
0052 84 F7      AND A #$F7
0054 B7 8001      STA A PIACTA SET STROBE LINE LOW
0057 8A 08      ORA A #8
0059 36          PSH A
005A 32          PUL A
005B 36          PSH A
005C 32          PUL A
005D 01          NOP THIS IS A DELAY SEQUENCE
005E B7 8001      STA A PIACTA STROBE LINE HIGH
0061 39          RTS

```

* THIS ROUTINE WILL SHIFT THE LEAST SIGNIFICANT
* NIBBLE (4 BITS) FROM 'VALUE' INTO ACC A.

```

0062 37          SHFTX4 PSH B
0063 C6 04      LDA B #4
0065 8D 05      SHFT4 BSR SHFTR SHIFT ONCE
0067 5A          DEC B
0068 26 FB      BNE SHFT4 LOOP 4 TIMES
006A 33          PUL B RECOVER VALUE
006B 39          RTS

```

```

006C 67 07      SHFTR ASR VALUE-HERE,X SHIFT MOST SIGNIFICANT BYTE
006E 66 08      ROR VALUE-HERE+1,X SHIFT LEAST SIGNIFICANT BYTE
0070 46          ROR A SHIFT INTO ACC A
0071 39          RTS
END
00 ERROR(S) DETECTED

```

SPEECH DRIVER INSTALLER

```

0010 LINE= 0
0100 PRINT CHR$(26);:REM CLEAR SCREEN
0110 REM YOU MUST SELECT AN AREA OF MEMORY INTO WHICH
0120 REM THE MACHINE LANGUAGE CODE FOR THE SPEECH DRIVER
0130 REM WILL BE PLACED. THIS AREA MUST REMAIN UNTOUCHED
0140 REM BY BASIC AND THE DOS/OPERATING SYSTEM. THIS
0150 REM AREA MUST BE 114 BYTES LONG. THIS PROGRAM AND

```

```

0160 REM THE OTHER PROGRAMS ASSUMES A LOCATION OF $A800
0170 A0=43008 : REM REPLACE THIS VALUE WITH YOUR ADDRESS
0180 REM YOU MUST KNOW THE LOCATION THAT CONTAINS THE USER
0190 REM VECTOR.
0200 A9=99 : REM ADDRESS OF USER VECTOR FOR SUPER BASIC
0210 PRINT "INSTALLING BASIC SPEECH DRIVER, PLEASE STAND-BYE"
0220 A=INT(A0/256)
0230 POKE(A9,A) : REM INSTALL MSB OF USER VECTOR
0240 A=A0-(256*A)
0250 POKE(A9+1,A) : REM INSTALL LSB OF USER VECTOR
0260 FOR X=0 TO 113
0270 READ A
0280 POKE(A0+X,A)
0290 NEXT X
0300 PRINT
0330 POKE(32769,0) : POKE(32768,255) : POKE(32769,60)
0340 POKE(32771,0) : POKE(32770,0) : POKE(32771,60)
0350 REM INITIALIZE PIA A SIDE FOR ALL OUTPUTS, CA2 HIGH
0360 REM INITIALIZE PIA B SIDE FOR ALL INPUTS
0370 A=USER(0) : REM RESET S2M2
0380 A=19991 : GOSUB 2000
0390 PRINT
0400 PRINT "SPEECH DRIVER INSTALLED, PORT INITIALIZED."
0410 PRINT "READY FOR USE !"
0430 READ A : IF A=0 THEN 450
0440 GOSUB 2000 : GOTO 430
0450 END
1000 DATA 141,0,48,238,0,49,49,32
1010 DATA 2,0,0,166,7,230,8,167
1020 DATA 8,231,7,170,7,38,12,198
1030 DATA 5,79,141,47,90,38,250,134
1040 DATA 128,32,40,79,141,37,79,198
1050 DATA 5,141,55,141,24,90,38,249
1060 DATA 134,128,141,23,134,160,141,19
1070 DATA 134,224,141,15,79,141,12,182
1080 DATA 128,2,42,251,57,54,134,32
1090 DATA 141,1,50,67,183,128,0,182
1100 DATA 128,1,132,247,183,128,1,138
1110 DATA 8,54,50,54,50,1,183,128
1120 DATA 1,57,55,198,4,141,5,90
1130 DATA 38,251,51,57,103,7,102,8
1140 DATA 70,57
1800 DATA 19513,20492,9765,20492,-16631,0
1810 REM 1800 WILL SAY "READY TO TALK TO YOU"
2000 IF A<0 LET A=65536+A
2010 POKE( A0+9,INT(A/256))
2020 POKE( A0+10,A-256*INT(A/256))
2030 A=USER(0)
2040 RETURN

```

SBC/02 MONITOR WORKS WITH SWTBUG PROGRAMS

By Phil Sanders

Programs written for the SWTBUG monitor can be used with the SBC/02 monitor (monitor for the 6809 version of the SBC/9) with the following transfer addresses. This is provided that the program does not make subroutine calls other than the usual (INCH, OUTCH...) as listed in Appendix D of the LFD-400 or LFD-400

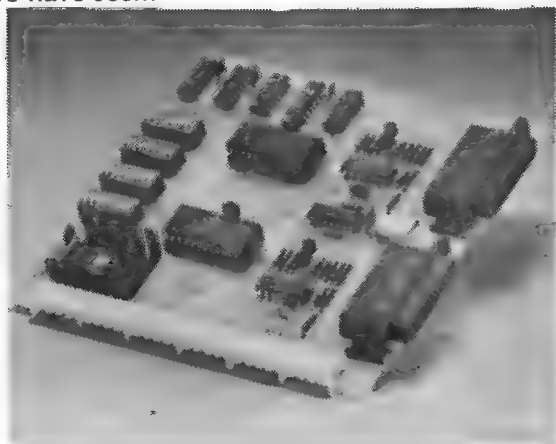
EX manual. Transfer addresses can reside in either RAM or ROM from \$E000 to \$E3FF. These addresses being filters can add or enhance SWTBUG compatible programs by jumping to a modifying subroutine before jumping to the SBC/02 monitor's vectors.

An LFD-400/800 controller card, decoded for \$E000-\$EFFF instead of \$C000-\$CFFF, was used for a PROM board. To decode the controller, to \$E000-\$EFFF, (1) cut the B10 pin 3 trace (to Address 13), (2) jumper from pin 40 of the Molex bus connector (Address 13) to A4 pin 13, and (3) jumper A4 pin 12 to B10 pin 3.

(E1AC)	ORG	\$E1AC	
E1AC 7E FD33	JMP	\$FD33	INCH
(E1D1)	ORG	\$E1D1	
E1D1 7E FD26	JMP	\$FD26	OUTCH
(E0CC)	ORG	\$E0CC	
E0CC 7E FD9A	JMP	\$FD9A	OUTS
(E06B)	ORG	\$E06B	
E06B 7E FD1C	JMP	\$FD1C	OUTHR
(E0C8)	ORG	\$E0C8	
E0C8 7E FD96	JMP	\$FD96	OUT4HS
(E07E)	ORG	\$E07E	
E07E 7E FD4B	JMP	\$FD4B	PDATA1
(E0E3)	ORG	\$E0E3	
E0E3 7E FD65	JMP	\$FC65	CONTRL
(E047)	ORG	\$E047	
E047 7E FDF8	JMP	\$FCF8	BADDR
	END		

NEW PRODUCTS

We introduce new products for SYSTEM-50 computers several times a year. Our latest is a dual asynchronous serial communications interface module for the 30-pin bus. This SIO card packs more features per dollar than any we have seen.



Features:

- ☆ Available with or without an optional on-card bit-rate generator (BRG). The BRG may be used to produce transmit/receive clock rates, thereby freeing up to five pins on the system bus for other use -- such as extended 1Mbyte addressing.
- ☆ Compatible with both the older and newer versions of the Systems-30 bus.
- ☆ Design permits control of serial-to-parallel and parallel-to-serial data conversion, parity generation and verification, and modem control -- with minimal software overhead.
- ☆ Output signals of each channel are current-limited for protection against a short-circuit load.

☆ Transmit and receive rate of each channel may be individually selected. Moreover, the transmit rate of a channel may be different from its receive rate. Data rate: 110, 300, 1200, 2400, 4800, 9600, and 19200 bits/second.

☆ Communications signals are compatible with RS-232-C standard levels. Clock signals are TTL compatible.

☆ Low price: Only \$59.95 without the optional bit-rate generator, only \$74.95 with the BRG components installed. Field upgrade BRG kit is only \$19.95.

Some thumbnail descriptions of some more new products are set forth below. These briefs were prepared by Dale French of our technical staff.

M24SS Static RAM Card: A 24-Kbyte static RAM board organized into three independent 8-Kbyte blocks. Works with either the standard SS-50 bus or the 1-Mbyte extended addressing bus. Comes assembled, burned-in and tested. Users manual includes source listing of diagnostic memory test. Also available in 8- and 16-Kbyte configurations.

M48DSS Dynamic RAM Card: A low power 48-Kbyte dynamic RAM board organized into three independent 16-Kbyte blocks. Works with either the standard SS-50 bus or the 1-Mbyte extended addressing bus. Comes assembled, burned-in and tested. Users manual includes source listing of diagnostic memory test. Also available in 16- and 32-Kbyte versions.

ColoRAMa-50: A memory-mapped color VDC board. Generates alphanumeric, semi-graphic displays. Full graphic resolutions range from 64 x 64 pixels to 256 x 192 pixels. Displays in two, four or eight colors, depending on the display resolution. Two- and four-color displays may be complemented. Board is designed to accommodate a low cost Radio Shack modulator for TV set display. Comes with on Kbyte of display RAM which provides for alphanumeric, semigraphics and two low-density full graphic display formats. Also provides for 2-Kbyte EPROM. Cassette I/O provides for low-cost tile storage. Users manual includes source listing of display OS. Works with 1-Mbyte extended addressing bus. The ColoRAMa-50 occupies an 8-K-byte block of memory in the upper half of a 64-Kbyte address space. Board accommodates additional RAM for higher density display modes.

The COLOR CONNECTION: A cable/circuit card assembly which is used to adapt the 6809-based TRS-80 Color Computer to the SS-50 bus. The COLOR CONNECTION allows access to LFD-400 mini-disk storage, RAM

expansion, interfacing (via the ELECTRIC WINDOW, e.g.) to a word-processing quality BW display system, etc.

SS-50 Bus Motherboard: A seven-slot system bus card that can also be used as an extender card for servicing function cards.

SS-30 Bus Motherboard Kit: Accommodates up to eight 30-pin I/O cards. Supplied complete with PC board connectors and components required for application as an I/O

extension motherboard for the SS-50 bus.

Since the last Peripheral was issued, many new 680X programs have been released, including MPX/9, a 6809 DOS for our LFD disk systems, and a 6809 version of Percom Super BASIC.

To place an order or request product literature, call our toll-free order number, 1-800-527-1592. For additional technical information call (214) 272-3421.

Exorciser Compatible Products

Motorola's EXORciser is a versatile, industrial quality 680X microcomputer. It uses an 86-pin system bus, with standard gold-plated edge type connectors for function cards. Our EXORciser compatible boards, called ModuEX modules, are equal in quality to Motorola modules but cost far less. Included in this product line is the LFD-400/800 EX mini-disk system; a VC-EX memory-mapped video display card; and, the M64EX, a 64-Kbyte dynamic RAM card. A 6809 MPU card is in the board-layout stage of development. Software for these systems include a number of monitors -- MIKBUG,

EXBUG and others -- configured for LFD-400/800 EX operation, Percom Super BASIC, an editor and business application programs.

I/O subroutine entry addresses for EXBUG 1.1, EXBUG 1.2 and CRTBUG, plus an entry address for the MINIBUG III CONTRL subroutine have been established. These are set forth in the table below, and are to be added as an extension to Appendix D of the LFD-400/800EX Users Manual. We will soon release similar entry addresses for D3BUG1, D3BUG2, and MIKBUG 2.0. If you are interested in using the LFD-400/800EX with one of these monitors, or if you have a monitor that is not listed in Appendix D of the Users Manual, contact Percom.

ROUTINE	MIK BUG	MICRO BUG	MINI BUG II	MINI BUG III	TVBUG	EXBUG 1.1	EXBUG 1.2	EXBUG 2.1	SYS MON CMS	CRTBUG
INCH	E1AC	FD33	E11F	E133	F800	F015	F015	F015	F9D1	E508
OUTCH	E1D1	FD26	E108	E126	F803	F018	F018	F018	F9E8	E494
OUTS	E0CC	FD9A	E180	E19A	F9B4	F02A	F02A	F02A	F8EB	E427
OUTH	E06B	FD1C	E0FE	E11C	F986	FA1C	FA0F	F0D0	F881	F3C8
OUT4HS	E0C8	FD96	E07C	E196	F80F	F01E	F01E	F01E	F8E7	F423
PDATA1	E07E	FD4B	E130	E14B	F806	F027	F027	F027	F894	E3D9
CONTRL	E0E3	FC65	E040	E065	F821	F564	F564	F564	F81C	E09B
BADDR	E047	FCF8	E0D9	E0F8	F809	F00F	F00F	F00F	F864	E3A4
I/O TYPE ADDRESS	PIA 8004	ACIA 8408	ACIA 8008	ACIA 8008	PIA F404	ACIA FCF4	ACIA FCF4	ACIA FCF4	ACIA E3C0	ACIA/PIA 8008/8044

A supplement to this issue of the **Peripheral** is available from Percom Data Company. The supplement includes more specific information --for example, notes on product improvement and maintenance -- and a 'short-form' product price list. This supplement, which is automatically mailed to subscribers of the **Peripheral**, may be obtained from Percom by calling our toll-free order number, 1-800-527-1592. From within Texas, call (214) 272-3421.

TRADEMARKS APPEARING IN THIS ISSUE OF THE PERIPHERAL:

Percom Data Company, Inc.: ColoRAMa-50, the COLOR CONNECTION, ELECTRIC CRAYON, ELECTRIC WINDOW, EXDOS, INDEX, LFD-400, LFD-800, ModuEX, MPX/9, PSYMON and SBC/9.

Motorola Corp.: EXBUG, EXORciser, MICROBUG, MICRO CHROMA, MIKBUG and MINIBUG.

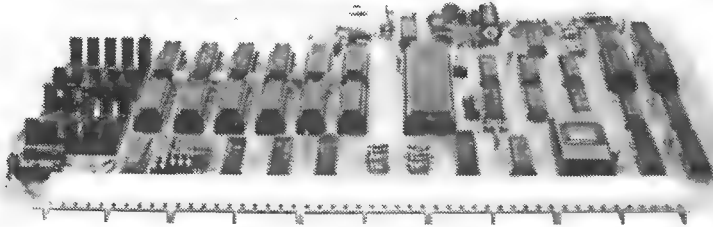
Tandy Radio Shack Corp.: TRS-80

Microware® Systems Corporation: OS-9

Technical Systems Consultants, Inc.: FLEX, FLEX/9, UNIFLEX

Now! Color for Your...

SYSTEM-50



Introducing COLORAMA-50™ Percom's SS-50 Bus Color VDG

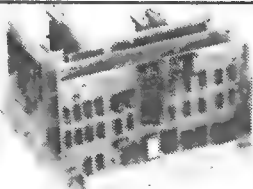
Introductory
Price

\$219.95

Featuring...

- **Eleven display formats** including 8-color semigraphics, 4-color graphics, 2-color high density graphics and 2-color alphanumerics.
Moreover, two- and four-color displays may be switched between primary and complementary color sets under software control or from the keyboard.
Full graphic resolutions range from 64 x 64 picture elements to 256 x 192 picture elements.
- **Instant display control:** The COLORAMA-50™ is memory mapped; your MPU has direct, instant access to display RAM and display control registers.
- **Low-cost Modulator Option for Color TV Interface:** The COLORAMA-50™ provides for installation of an inexpensive RF modulator such as Radio Shack PN 277-122 for operation using a color TV.

- **Mix in Sound:** With the optional modulator installed, you can complement your colorful displays with software-controlled audio.
- **Extended Addressing:** The COLORAMA-50™ is compatible with the SS-50A bus and the extended-address SS-50C bus. Map the board into any of the sixteen 64-Kbyte banks of the 1-Mbyte SS-50C address space. The COLORAMA-50™ card "defaults" to the first (lowest) bank for the SS-50A bus.
- **Cassette I/O Option:** Add a few inexpensive components to the on-card circuitry provided and use an audio cassette for program/data storage.
- **Provision for On-Card Firmware:** Put your display operating system, cassette control program, etc. right on the COLORAMA-50™ card in a 2516 (5-volt 2716) EPROM. Resides in the top 2-Kbyte of the card memory space.
- **Operating Software:** Included in the comprehensive users manual is a listing of a display operating system and cassette controller that may be implemented as a callable subroutine function from BASIC or existing operating systems. The programs are optionally available in a plug-in ROM for just \$69.95.



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- ✓ Color and monochrome memory-mapped display controllers
- ✓ Extendable 7-slot SS-50 bus motherboards
- ✓ Versatile prototyping boards: SS-50 and SS-30 bus
- ✓ Field-proven software: monitors, operating systems, drivers, editors, assemblers, debuggers and HLLs.

System Requirements

The COLORAMA-50™ is pin- and outline-compatible with the Percom System-50™ bus, the SS-50A (SS-50) bus and the SS-50C bus. The composite video-sync signal output will directly drive a color (or BW) video monitor. The output may be modulated for operation with a standard (NTSC) TV set. A modulator is not included. The COLORAMA-50™ card occupies 8-Kbytes of memory in the upper half of a 64-Kbyte memory space. Included on-card is 1-Kbyte of display RAM which will accommodate alphanumeric displays, semigraphic displays and two low-density full-graphic displays. For the higher density graphic displays, additional display RAM is required. The optional RAM ICs may be installed on the card.

For quality Percom SS-50 bus products, see your nearby authorized Percom dealer. To order direct, call toll-free, 1-800-527-1592. Prices and specifications subject to change without notice. Prices do not include shipping and handling.

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SOFTWARE DEPARTMENT

(ALL PROGRAMS PROVIDED IN SOURCE ON DISK SPECIFY 5"8")

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—output disk file may be source or new binary file
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—includes assembler language XREF program
—contact SMOKE or CER-COMP for non-FLEX* systems

Z-80/8080/8085 Disassembler (Similar to SLEUTH) \$ 99.00
—runs on 6800/1/9, analyzes Z-80/8080/8085

6800/1,6805, 6502,Z-80,8080/5 Cross-assemblers EACH \$ 50.00
—macro sets for TSC 6809 Macro Assembler ANY 3 \$100.00

FULL-SCREEN FORMS DISPLAY for TSC 6809 X-BASIC \$ 50.00
—display and edit for terminals and video displays
—complete cursor control for screen input/output
—interactive forms generator/documentor provided

FULL SCREEN MAILING LIST System for TSC 6809 X-BASIC \$ 100.00
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—generates TSC XPC BASIC sort/merge programs

HARDWARE DEPARTMENT

(ALL BOARDS BARE WITH FULL DOCUMENTATION PROVIDED)

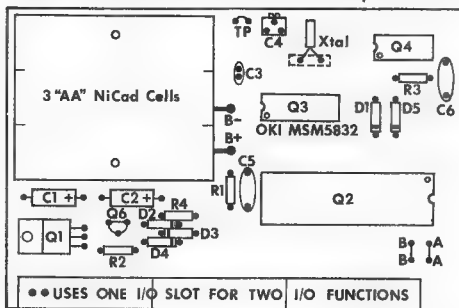
I/O SELECTRIC INTERFACE BOARD (serial or parallel) \$ 35.00
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Bare board* \$ 35.00 Shipping & handling \$ 3.00

* FULLY DOCUMENTED: instructions; diagrams; theory; more than 20 pages of sample software (automatically puts date in Flex2/9 date buffer, adds time-of-day to assembly listings, maintains constant, current time+date display on top line of CRT). Batteries not included. All IC's socketed.

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- * BAUD RATE IS PROGRAMMABLE TO 32K-baud
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6809

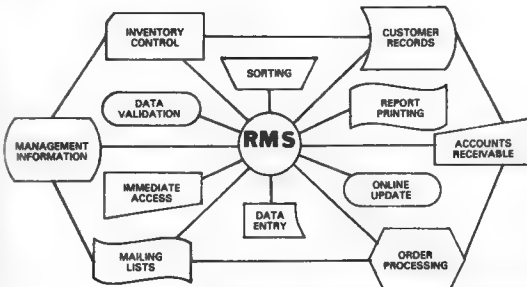
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RMS

DATABASE MANAGEMENT

- USER DEFINED RECORD FORMAT VIA DATA DICTIONARY
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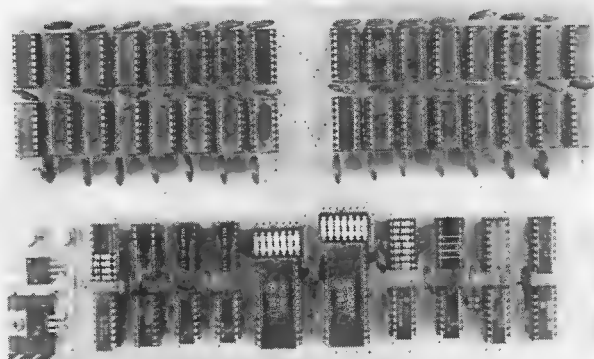
The initial version is for systems using the SWTP MP-09 CPU board and less than 64K of RAM; it does not support the DMF-2 disk. (Alternate versions available, including video-based versions). The price of \$75 includes two ROMs, complete manual, and either full, commented source listing or source code on disk — you choose!

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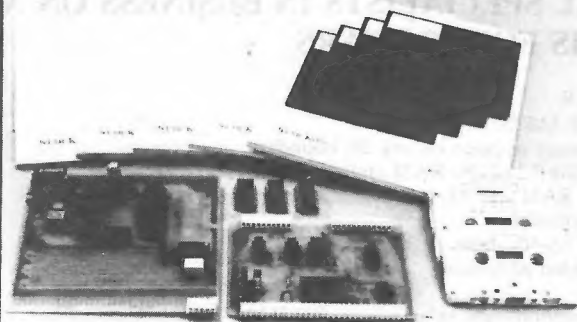
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SS-50 Bookstore

6809 Assembly Language Programming

This book presents a thorough introduction to assembly language programming and a complete discussion of the 6809 instruction set. It starts at a very basic level and builds into actual programming techniques, I/O structures, and hardware interfaces. By Lance Leventhal. 530 pages. Order No. 357 \$16.99

6809 Microcomputer Programming and Interfacing/Experiments

This book is written to give sound information on how to program and interface the 6809-the high performance 8-bit microprocessor. It contains seven chapters and four appendices and is valuable as a "cookbook" aid when working with the 6809. By Andrew Staugaard, Jr. - 304 pages - Order No. 21798 \$13.95

68000 Microprocessor Handbook

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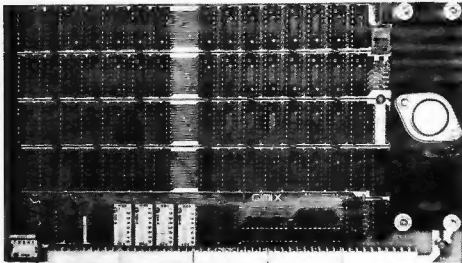
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